

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.





Reserve  
aG70  
.2  
.N38  
1991



**United States  
Department of  
Agriculture**



**National Agricultural Library**

United States  
Department of  
Agriculture

Forest Service

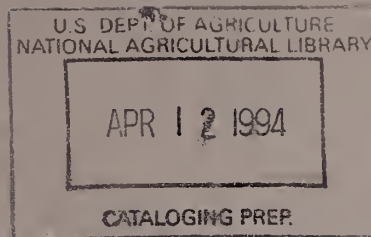
Computer Sciences &  
Telecommunications

Washington, D.C.

January 1991



# National Geographic Information Structure







United States  
Department of  
Agriculture

Forest  
Service

Washington  
Office

Reply to: 1390

Subject:: Geographic Information Structure

To: Regional Foresters, Station Directors, Area Director, and WO  
Staff Directors

In February 1989, we shared with you a proposed structure of organizing geographic information for testing and refinement "National GIS Plan, Geographic Information Systems, Component A, Action Item 3." Your use and testing has led to refinement of the **Existing Environment** category of the structure.

It is recommended that this refined structure be used by field units in developing information structures to organize their resource information. A standard structure for organizing and referencing geographic information is critical to successful implementation of GIS. An agreed-upon structure and language will improve our ability to access and share electronic data. This is essential to moving the Forest Service towards the vision of integrated information management.

A more simplified view of the structure pictures the three major parts as follows:

- The **Existing Environment** category is the basic inventory of what currently exists - where we are.
- The **Management Plans and Direction** category describes the goals and objectives of Forest Plans - where we are headed.
- The **Implementation and Monitoring** category is - how we get there.

Since your efforts led to refinement of the **Existing Environment** category, more work will be needed to sort out how **Management Plans and Direction** and **Implementation and Monitoring** categories will be dealt with by the Forest Service.

If you have questions regarding the geographic information structure, please direct them to the Director of Computer Sciences and Telecommunications Staff.

Charles R. Hartgraves  
Associate Deputy Chief

Enclosure.

Contents	Page
I. INTRODUCTION	1
II. DESCRIPTION OF THE STRUCTURE	1
A. Purpose	
B. Refinements	
C. Features	
III. SUMMARY	8
IV. RECOMMENDATIONS	8



## **I. INTRODUCTION**

A proposed structure for organizing geographic information was published in February 1989. Refer to the National GIS Plan, Geographic Information System, Component A, Action Item 3, also known as the "Brown Book", for definitions and background about the initial structure development. A basic premise of the initial effort was "to test and experiment with" the proposed structure, with an eye towards "future refinements" prior to nationwide GIS implementation.

Since that effort, the structure has been used and tested in various ways. Some field units with GIS technology have used the structure to develop a "user's view" of electronic data. Some have used it to organize the products from Information Needs Assessment efforts. At the national level, the structure provided a framework for development of data standards for commonly used resource data.

These experiences have enlarged understanding of the principles and issues relevant to organizing land-based information. The initial structure has been further refined to reflect this evolving understanding. The purpose of this document is to:

1. Describe the refinements and rationale for changes to the original structure.
2. Identify issues needing additional work and discussion to help move the agency towards an integrated information environment.

## **II. DESCRIPTION OF THE STRUCTURE**

### **A. PURPOSE**

Discussions about the original structure and an earlier draft of this paper indicate confusion may exist about the purpose and use of the structure. The information structure is intended to:

1. Describe a "user's view" of resource information.
2. Be a flexible framework which each level can develop to meet their needs to organize, store, update and share resource information.
3. Address issues that must be resolved to move from functionally-owned data to shared, integrated data.

The information structure is NOT:

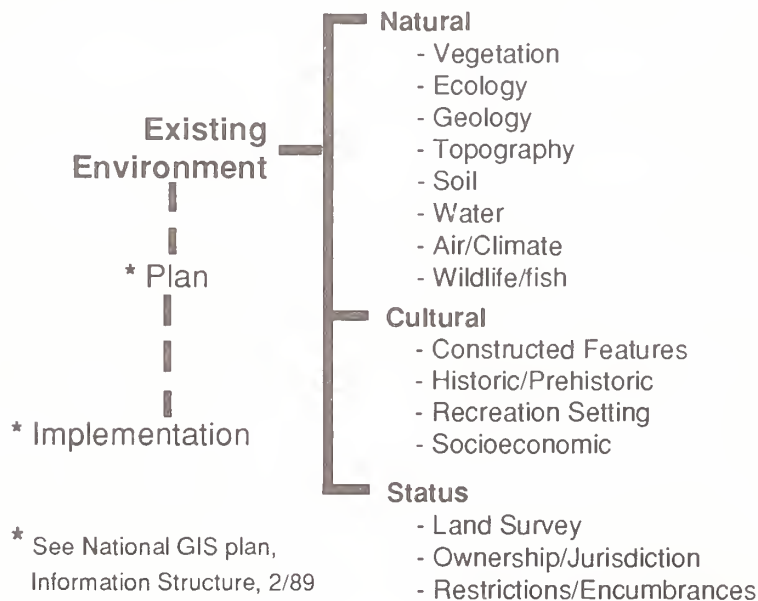
1. Prescribing standard "layers" or interpretations.
2. A physical database design.
3. Rigid, unchanging or all-inclusive.
4. Mandating the collection of new information.
5. Defining a minimum level of information requirements.

## B. REFINEMENTS

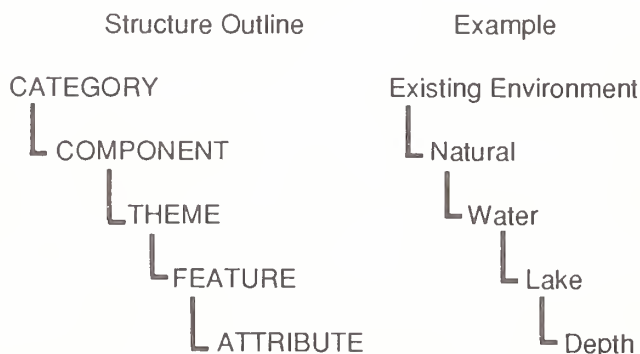
Because of the imminent GIS procurement and pressures on the field to respond to information demands, the most critical information to be automated is basic resource data. Therefore, efforts were focused on the Existing Environment Category during refinement of the structure. It is recognized that considerable effort will be needed to refine the other parts of the structure that deal with **Management Plans** and **Implementation and Monitoring**. Issues related to tracking activities and reporting need to be resolved.

In response to the more immediate needs of dealing with resource data, two major changes were made. The basic outline of the structure itself was modified and the content of the structure was changed.

### National Geographic Information Structure



Two major changes were made to the framework of the structure. Hierarchic levels were renamed and two new levels are added. The new framework and an example of the content is illustrated below.



---

## C. FEATURES AND ATTRIBUTES

Additions to the original structure are Feature and Attribute. Features can be mapped and located on the earth and are relatively persistent over time. They can be surveyed, measured, named and otherwise described. They are natural and cultural resources that field employees work with every day, such as streams, trees, roads, and buildings. Tables 1, 2, and 3 identify some commonly referenced geographic features in each of the Natural, Cultural, and Status Components. These represent the basic set of features commonly used across the Agency.

The examples of features shown are intended to be illustrative only and not all-inclusive. It is expected that these will be supplemented as needed to meet more specific Regional and local situations.

The inclusion of Features is an important addition to the structure. Features clarify subject areas of information in each THEME. Describing the types of geographic features in each THEME should improve consistency in the way electronic information about resources is organized and referenced. Features are also the important link to data standards in the form of attributes.

Attributes are associated with Features. Attributes describe characteristics, measurements, and other facts or observations about geographic Features. For example, Attributes about the Feature "tree" might be that it is a ponderosa pine, 100 feet tall, and has a broken top.

Relationships between features and attributes will need to be further defined as we move closer to database design. Table 4 displays an example of how the proposed data standards for water could be associated with water related features. Many attributes are very similar, such as names, numbers, and owners. These issues will need to be dealt with during data base design.

Data standards are considered to be the definition of attributes. Vegetation Height is an attribute. A data standard for Vegetation Height includes a definition, a convention for measurement and units of measure.

The following tables illustrate the types of Features found in each Theme. There are three tables, one corresponding with each of the three Components of Natural, Cultural and Status.



TABLE 1

Features in the "Existing Environment" CATEGORY, "Natural" COMPONENT

THEMES	FEATURES	DEFINITIONS / EXAMPLES
VEGETATION	Stands	Areas of homogeneous vegetation.
	Plants	Individual trees, shrubs, and grass/forbs of special interest.(e.g genetically superior trees, threatened/endangered plants, snags)
ECOLOGY	Ecological Map Unit	Areas of land with unique biotic an Units abiotic conditions with similar potentials to produce vegetation and respond to management activities (e.g., Ecological Land Types)
GEOLOGY	Geologic Formation	A mappable body of rock identified by distinctive characteristics and stratigraphic position. (e.g. Mancos shale, Navajo sandstone)
	Geologic Features	Naturally occurring structure, outcrop, or landform of significant interest. (e.g. caves, lava tubes outcrops)
	Geologic Hazard	Condition that poses a risk to health or safety or has potential adverse impacts on resource values or property. (e. g. avalanche hazard, floodplain, landslide)
	Aquifer	Geologic formation that can yield significant quantities of ground water to wells and springs. (e.g. Ogala aquifer)
	Mineral Deposit	Concentration of solid, liquid or gaseous material in form and amount such that economic extraction of commodities is or may become feasible. (e.g., oil and gas field, gravel bed)
TOPOGRAPHY	Terrain Features	The characterization of the the shape of the Earth's surface (e.g. point measurements of elevation, contours)
SOIL	Soil Map Units	Areas of similar soil and topographic characteristics

**TABLE 1** (Continued)

THEMES	FEATURES	DEFINITIONS/EXAMPLES
WATER	Water Courses	Flowing water (e.g. rivers, streams, creeks, brooks)
	Water Bodies	Standing water (e.g. lakes, reservoirs, ponds, oceans)
	Wetlands	Areas of land characterized by the interface between aquatic and terrestrial ecosystems (e.g. marshes, swamps, bogs, estuaries)
	Springs/Seeps.	Places where ground water is discharged to the surface.
	Watersheds	Identifiable areas which drain to particular water courses/water bodies.
AIR/CLIMATE	Pollution Source	Point pollution sources of interest. Lightning Strike... Ground locations of lightning strike points. (e.g. fire origin)
WILDLIFE/FISH	Habitat Components	Special components of fish and wildlife habitat. (e.g. elk wallows, migration corridors, spawning beds, strutting grounds, nest sites)
	Unique Habitat	Habitats of special interest. (e.g. threatened & endangered species habitat)

TABLE 2

Features in the "Existing Environment" CATEGORY, "Cultural" COMPONENT

THEMES	FEATURES	DEFINITIONS/EXAMPLES
CONSTRUCTED FEATURES	Transportation	Facilities related to ground, air, and water transportation systems (e.g. roads, trails, railroads, bridges, tunnels, culverts, airfields, heliports, canals/ditches, locks, flumes)
	Utilities	Facilities related to power communication systems (e.g. pipelines, power lines, telephone lines, electronic sites)
	Buildings, Dams & Other Structures	Facilities designed and built to support, shelter, enclose, or store persons, animals, or materials. (e.g. offices, cabins, guard stations, lodges, dams, lookout towers, water tanks, nest boxes, fences, cattleguards)
	Developed Sites	Sites developed for specific purposes, often with a combination of constructed facilities (e.g. ski areas, campgrounds, nurseries, solid waste facilities, water/wastewater treatment plants, mines/quarries, airports, Ranger Stations)
RECREATION SETTING	Recreation Composites	Areas managed as a whole to provide a desired mix of recreation experiences (e.g. The Metolius River Corridor, Maroon Valley, Flaming Gorge NRA.)
	ROS Class	Areas of land classified according to general potential or recreation activities and opportunities (e.g. Primitive, Roaded Natural)
	Special Places	Places of special significance to a segment of the public for which there is no administrative or legislative designation (e.g. spiritual sites, user-developed hunting camps)
	Visual Condition Classes	The classification of areas according to existing visual quality conditions.
HISTORIC & PREHISTORIC	Cultural Properties	Sites managed for their cultural significance (e.g. pueblo ruins, historic cabins, battlegrounds)
SOCIO-ECONOMIC	Statistical Summary Areas	Demographic, social, and economic characteristics of an area (e.g. census tracts, standard metropolitan areas, states, counties)



**TABLE 3**

Features in the "Existing Environment" CATEGORY, "Status" COMPONENT

THEMES	FEATURES	DEFINITIONS/EXAMPLES
LAND SURVEY	Corner Monuments	Surveyed property corners
	Public Land Survey	Survey lines and subdivisions of the Public Land Survey System (e.g. townships, sections, principal meridians)
	Metes/Bounds	Areas described by surveyed tract boundaries within a Metes/Bounds land area.
OWNERSHIP & JURISDICTION	Political Subdivisions	Areas within political jurisdictions (e.g. States, counties, Towns, Congressional Districts)
	Forest Service Units	Areas within Forest Service Units administrative (e.g. Regions, National Forests, Ranger Districts, Research Stations)
	Land Ownership	Areas identified by ownership (e.g. Private, State, County, Federal, and sometimes by specific owner or administrator (e.g. Phelps-Dodge, Black Butte Ranch, Bureau of Land Management)
RESTRICTIONS & RIGHTS	Easements	Areas or parcels with easements or other outstanding rights. (e.g. Federal Highway easements, subsurface mineral rights)
	Withdrawals	Areas withdrawn or specially designated through administrative or Congressional action (e.g. mineral withdrawals, wilderness)
	Special Uses	Allowed uses and facilities under Special Use Permit.

### III. SUMMARY

A standard structure for organizing and referencing geographic information is critical to successful implementation of GIS. An agreed-upon structure and language will improve our ability to access and share electronic data. This is essential to moving the Forest Service towards the vision of integrated information management.

A common structure will also assist movement towards a physical database design for resource information by better describing geographic features, and the relationships between features and attributes. And finally, the structure should help us design a consistent Service-wide user interface to automated geographic information.

### IV. RECOMMENDATIONS

It is recommended that the refined structure in this document be used by field units in developing information structures to organize their resource information. The foundation of an integrated data base will be in the adoption of uniform attributes, or data standards, for commonly used Features. Data standards and their associations to Features are the next step towards development of an actual data base.

A more simplified view of the information structure is that of viewing the three major parts of the structure as follows: The "Existing Environment" category is the basic inventory of what currently exists--where we are.

The Management Plans and Direction Category describes where we are headed--the goals and objectives of Forest Plans. The Implementation and Monitoring Category is the "How we get there". In the process of implementation, the Existing Environment is changed, dictating changes in the basic inventory.

More work is needed to sort out how information about plans and activities will be dealt with by the organization. At some point, much of the updating of the database must become a "by-product" of routine business activities. The movement of information within the organization for reporting must become much less labor-intensive than at present.

Technologies that hold potential to "automate" database updating are evolving rapidly. Geographic Positioning Systems (GPS) integrated with other technologies, particularly remote sensing, hold great promise in reducing the difficulty of maintaining current, accurate databases.

## APPENDIX A

### Summary of Refinements and Modifications in the Structure.

Over the past year, the structure has been refined and modified. This is a summary of changes made to arrive at the current structure.

1. Additional levels have been added and the terminology used to describe the structure has been modified.

Original Structure - 2/89	Current Structure - 9/90
CATEGORY	CATEGORY
SUB-CATEGORY	COMPONENT
COMPONENT	THEME
	FEATURE
	ATTRIBUTE

The top three levels of the structure have been renamed, but their definitions and intent have remained basically the same. FEATURES and ATTRIBUTES were added.

2. Some THEMES have been added, combined, or renamed.  
The structure proposed in February 1989 contained 9 THEMES in the "Natural" COMPONENT. The current structure has 8 THEMES.

An "Ecology" THEME was added. The addition of the "Ecology" THEME clarifies the difference between information about existing and potential communities. This theme was added in response to a commonly expressed need to track information about various classification schemes that are used, such as "habitat types", "potential natural vegetation", "ecological land units", and the like.

Two THEMES, "Fire Occurrence" and "Insect & Disease Occurrence", were removed from the "Natural" COMPONENT. When discussing the broad subject area of fire and insect and disease as shown in the original structure, no features in the way they are currently understood could be clearly identified. There was some discussion about Features that somehow related to "Current Infestations" or similar occurrences.

Problems with this view fell in two broad areas. The first is the extremely changeable nature of this sort of information. For example, in some areas insect populations are monitored via remote sensing as often as seven times per year to coincide with the seven generations of insects. Likewise, a fire may be monitored daily or even more often. These events may have no significant long term effects on the resources, such as a light defoliation for a season or a light surface fire.

The other major difficulty is related to the precision of this relatively transitory data. GIS databases are quite demanding in the degree of positional accuracy required for information to "fit". Much of the data collected related to fire and insect and disease occurrences is not located as rigorously as demanded by a GIS. There is rapidly evolving technology that hold promise in dealing with these two issues, but at this point it is unclear how to deal with this class of information.



---

Currently there are two broad information needs related to fire and insect and disease occurrences. The first is tracking and displaying current status. This need is commonly met by aerial surveys that have the findings mapped, such as annual "sketch map" surveys. The other need is in the area of risk assessment and forecasting. These are two different needs and they are probably best met differently.

For example, fuels related data is a condition, or attribute, of existing vegetation. Information about fire lines and fuel breaks could be found in the "Constructed Features" THEME. Fire management areas and other fire planning information would be found in the "Management Plans & Direction" CATEGORY. And finally, much of the fire prevention and suppression information is associated with "protection" activities, and would be found in the "Implementation & Monitoring" CATEGORY of the structure.

In another example, dwarf mistletoe or other diseases are generally considered a condition of vegetation - an attribute. This is our most useful view of mistletoe. Insects are less clear as an example. Insects can vary widely in numbers and locations from year to year. In discussion with specialists, it was agreed that many of their needs to forecast susceptibility and risk can be interpreted from the basic data in the "Existing Environment" category. Age, species mix, elevation and other attributes that are used in risk assessment are already identified and accommodated by the structure.

In the "Cultural" COMPONENT, the original structure contained "Transportation Facilities" and "Non-Transportation Facilities" THEMES. These have been combined into one "Constructed Features" THEME.

Finally, the originally proposed structure contained 6 THEMES in the "Status" COMPONENT. These were combined into 3 THEMES.

TABLE 4

Water Related Features and Attribute Data Standards

Water Attribute Data Standards	Water Features				
	Water Course	Water Body	Wetland	Spring/ Seep	Water- shed
1) Stream Category	X				
2) Stream Order	X				
3) Stream Shade	X				
4) Stream Width	X				
5) Surface Water					
Gradient	X				
6) Suspended Sediment					
Concentration	X				
7) Velocity	X				
8) Barriers	X				
9) Bedload	X				
10) Embeddedness	X				
11) Fish Migration					
Barriers	X				
12) Flow (Discharge)	X			X	X
13) Sediment Discharge	X				
14) Aqua. Habitat Type	X	X			
15) Average Depth	X	X			
16) Debris	X	X			
17) Fish Cover	X	X			
18) Large Woody Debris	X	X			
19) Maximum Depth	X	X			
20) Substrate	X	X			
21) Clarity		X			
22) Flushing Period		X			
23) Lake Volume		X			
24) Littoral Area		X			
25) Stratification		X			
26) Trophic Class		X			
27) Shoreline					
Development Ratio		X	X		
28) Alkalinity	X	X	X	X	
29) Conductivity	X	X	X	X	
30) Dissolved Oxygen	X	X	X	X	
31) Fecal Coliform	X	X	X	X	
32) pH	X	X	X	X	
33) Temperature	X	X	X	X	
34) Turbidity	X	X	X	X	
35) Drainage Area					X
36) Hydrologic Unit					X
37) Precipitation					X
38) Evapotranspiration					
Rate					X
39) Snow Pack Depth					X
40) Snowpack Water					X
Equivalent					





NATIONAL AGRICULTURAL LIBRARY



1022271358

01



\* NATIONAL AGRICULTURAL LIBRARY



1022271358